Evaluation of Juvenile Oncorhynchus mykiss Migration and Life History Expression in the Calaveras River using Streamwidth Passive Integrated Transponder Technology

Chrissy L Sonke

Public Comments

No public comments were received for this proposal.

Technical Synthesis Panel Review

Proposal Title

#0048: Evaluation of Juvenile Oncorhynchus mykiss Migration and Life History Expression in the Calaveras River using Streamwidth Passive Integrated Transponder Technology

Final Panel Rating
adequate

Technical Synthesis Panel (Primary) Review

TSP Primary Reviewer's Evaluation Summary And Rating:

This project seeks to evaluate the migration and life history of steelhead in the Calaveras River using Streamwidth Passive Integrated Transponder Technology (PIT tags). PIT tag detectors will be set up along the river to detect movement of fish between different monitoring stations. The investigators will also have portable tag detection equipment that they can use to find subjects that have had little to no movement. There are three main goals of this project: (1) evaluate passage obstructions within Mormon Slough and Old Calaveras River Channel and to assist in prioritizing structural improvements for salmonid passage and provide information for useful monitoring, (2) identify potential solutions to passage obstacles, (3) to evaluate steelhead life history characteristics to better understand the factors that affect life history and to determine if water management would be the best option to remove these natural impediments. The design of this project is sound, but the project will succeed or fail based on the function of the PIT detectors. While the topic is important and could benefit the restoration efforts in this river system by providing knowledge about what mgiht potentially impede a migrating steelhead,I do not feel that the researchers have addressed the issue of data analysis as strongly as they needed. As PIT tags record data 24 hrs/day, 7

days a week there will be a very large data set to maintain and analyze. There was no mention as to how this was going to be done.

Additional Comments:

Overall, all of the reviewers thought that this was a valuable project. The goals and objectives/hypothesis were generally clear. The project was well designed; however, there were several questions that still need to be answered. For instance, two of the reviewers felt that the investigators would have a hard time associating the habitat data with the in stream data. Additionally, there was concern as to the complexity of the project and that they might be over ambitious in their goals. The feasibility of the project is appropriate although there were several key pieces of information missing. For instance, there is no mention of general stream characteristics. The products of this project will be valuable in the implementation of water management projects to improve fish migration. All reviewers agreed that the budget was reasonable.

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Technical Synthesis Panel (Discussion) Review

TSP Observations, Findings And Recommendations:

Elevation of juvenile Onchorhynchus mykiss migration and life history expression in the Calaveras River using streamwidth passive integrated transponder technology

This proposal outlines an innovative approach. The PIT tag approach is applicable and needed. Research will be able to test the effectiveness of the technology. The technique could be especially effective for detecting local effects of impediments to juvenile salmon habitat use and migration patterns. The panel expressed concern about the logistics of managing the large number of juveniles that would be released. The panel also had concern about how the large amount of data would be effectively managed and statistically analyzed. Additionally, several panelists felt there were too many hypotheses proposed. The proposal did not state specifically where or when the juveniles would be released. The experiment on the Calaveras River was well designed. The panel recognized that the PIT tagging technology is needed but the proposal is overly ambitious.

Final Ranking: Adequate

Technical Review #1

proposal title: Evaluation of Juvenile Oncorhynchus mykiss Migration and Life History Expression in the Calaveras River using Streamwidth Passive Integrated Transponder Technology

Review Form

Goals

Are the goals, objectives and hypotheses clearly stated and internally consistent? Is the idea timely and important?

Comments	**The goals, objectives and hypotheses are stated and internally consistent. At times the goals and objectives are somewhat vague. This seems to be due at least in part to this study being a first of its kind so that a good expectation of results is not known. A few of the goals and objectives seem to be overly generalized and overly ambitious, but all in all are attainable.**
Rating	**good**

Justification

Is the study justified relative to existing knowledge? Is a conceptual model clearly stated in the proposal and does it explain the underlying basis for the proposed work? Is the selection of research, pilot or demonstration project, or a full−scale implementation project justified?

Comments	**The existing knowledge related to migratory patterns in this system is beyond my expertise, but summarized on page 5 of the proposal. A generalized conceptual model for the work is included as Fig 4, page 20. The exact contribution to this model is not explained explicitly in the proposal, but the relationship is fairly straightforward.** **I believe that the budget to demonstrate this**

	technique over a three−year period with up to 500 individuals per year is appropriate size of the current study.
Rating	**good**

Approach

Is the approach well designed and appropriate for meeting the objectives of the project? Is the approach feasible? Are results likely to add to the base of knowledge? Is the project likely to generate novel information, methodology, or approaches? Will the information ultimately be useful to decision makers?

Comments	**Some of the methods to meet specific objectives are vaguely defined. As an example, Objective 5 reads exampine relationship of salmonid passage timing, location, size/age distribution (at realease) with environmental, structural, and biological factors. This is a very interesting objective, but also extremely complex. No specific objectives are specified other than using "appropriate" statistical tests.** **The authors' description and experience with the surgical insertion of the tags is included in the proposal, but not entirely convincing. Do the tags and or surgical procedure affect fish behavior? Is 24 hours of observation in the tanks post surgery and prior to release sufficient to determine if the insertion site will lead to infection?** **While capturing and tagging up to 500 individuals annually is ambitious, I wonder if this sample size is sufficient to resolve all of the proposed potential relations, given the large number of variables that are proposed to be investigated. If the 500 individuals are released at similar times to one another, the range of environmental conditions that they experience, particularly at any single given obstruction may be very small. If experimental design has been done to arrive that this sample size, it has**

	not been explained in the proposal. If there is a scheme for planning release so that a range of environmental and operational conditions will be more likely to be encountered, this is not described in the proposal.
Rating	**good**

Feasibility

Is the approach fully documented and technically feasible? What is the likelihood of success? Is the scale of the project consistent with the objectives and within the grasp of authors?

Comments	**The approach is fully documented if Appendix A explaining the operation of PIT is included. The likelihood of success as measured by accomplishment of all objectives to some extent is likely. The likelihood of complete and thorough success of all objectives as described here is not very likely. The scale of the project is very consistent with a good initial study aimed at addressing the objectives and is within the grasp of the authors.** **The proposal cites studies demonstrating that the behavior of fish with tags of similar size is not affected.** **The location of fixed detectors at the upper and lower ends of both channels will lead to overall passage use as a function of environmental conditions. This is likely to succeed. The interpretation of effects of specific obstacles will require a much finer spatial resolution and it's proposed to make this possible with the mobile units. The success of objectives listed regarding specific physical obstacles will require being at the appropriate locations with the mobile receiver at the time of flow conditions etc.**

that the fish are actually stranded. This is obviously much more complicated and labor intensive than operating the fixed stations. While terms like “regularly” and “often” are used to explain use of the mobile units the actual frequency of these field studies is not clearly specified in the proposal. Because of this, the overall expected spatial and temporal resolution of the study is not explicitly stated. If this resolution is not sufficient, many of the objectives may not be feasible.

The proposal discusses and diagrams two antennae configurations. It seems at though only the “pass-over” form is reasonable in this application because of the risk that an antennae reinforced with aircraft cable at or just above or below the water surface (required for “flow-through” design) poses. I think that this poses a risk greater than “a mild hazard or annoyance to recreational users”, as the authors point out. The pass-over design has a sensitivity of 3-4 ft laterally and vertically and will be placed on the stream bed. I assume that this range is when the antenna is well tuned, so at times may be slightly lower. The question as to whether this vertical range is sufficient for the chosen installation locations is not addressed in the proposal.

The proposers cite their own feasibility studies that had a high detection efficiency in 5 ft of water. It is not specified whether these studies used the flow-through or pass-over configuration.

Perhaps the least feasible objective seems to be locating non-migratory and stranded fish with the mobile detection station. If a fish

	fails to be recorded at any given station, it is either stranded, dead, or missed by the detector. Missing a detection at a single station is a very real possibility because other studies have shown detection efficiencies in the range of 72−97% for an individual antennae (page 12 of proposal). A fish that is detected upstream The authors state that "a few missed tags detections will no limit the interpretations of our results or our ability to accomplish our objectives". Hypothetically, if all of the tagged fish that are detected at one of the upstream locations successfully migrate downstream and past the downstream station, it is conceivable that as many as 20% (100 fish/year) will effectively be missing. The mobile detectors have an even poorer detection efficiency (around 50%), so it seems very possible that many more than "a few" fish will end up missing, not knowing whether they passed undetected to the tide−water or are stranded in the river. Searching either 18−mile stretch of river regularly and thoroughly will be difficult.
Rating	**good**

Monitoring

If applicable, is monitoring appropriately designed (pre−post comparisons; treatment−control comparisons)? Are there plans to interpret monitoring data or otherwise develop information?

Comments	**The study is essentially monitoring of migration patterns and then correlation of this data to other factors. This is the interpretation portion of the proposal and is significant, although it is not clear how much interpretation will be done during the three year period and to what extent the data acquired during this three year period will be used for later interpretation. The proposal reads as though both will occur. The monitoring seems to be appropriately**

	designed.
Rating	good

Products

Are products of value likely from the project? Are contributions to larger data management systems relevant and considered? Are interpretive (or interpretable) outcomes likely from the project?

Comments	There are certainly products of likely value from this project regarding migration patterns in relation to the two channels. The interpretation of these in terms of specific obstacles in the flow is also proposed, but the accuracy of these and value to larger systems isn't guaranteed. Interpretive and interpretable outcomes are likely, see above answer.
Rating	good

Additional Comments

Comments	

Capabilities

What is the track record of authors in terms of past performance? Is the project team qualified to efficiently and effectively implement the proposed project? Do they have available the infrastructure and other aspects of support necessary to accomplish the project?

Comments	I am certain that the funding agency is familiar with both USFW and SP Cramer and Associates.
Rating	very good

Budget

Is the budget reasonable and adequate for the work proposed?

Comments	yes

Rating	**good**

Overall

Provide a brief explanation of your summary rating.

Comments	**The proposal addresses a useful and specific question related to migratory patterns in one particular stream with a novel and appropriate experimental technique. I believe that it will be successful and lend some useful information, although possibly not to the complete satisfaction of all objectives, of which some are somewhat vague. The weakness of this proposal is proposing additional and numerous objectives that depend on a data set with a reliability, and high spatial resolution of the system. It's not clear to me because of lack of details in the proposal if the proposed use of the mobile detector will be sufficient for achieving goals related to fine spatial scaled (individual obstacles) and it is also not clear if the data proposed to be collected is really sufficient to address the numerous possible relationships between migratory patterns and physical and environmental variables described here.**
Rating	**very good**

Technical Review #2

proposal title: Evaluation of Juvenile Oncorhynchus mykiss Migration and Life History Expression in the Calaveras River using Streamwidth Passive Integrated Transponder Technology

Review Form

Goals

Are the goals, objectives and hypotheses clearly stated and internally consistent? Is the idea timely and important?

Comments	**The goals are clearly stated, both in the text and in the form of testable hypotheses. The research would make a contribution to the restoration of steelhead in the Central Valley by developing reach−specific estimates of movements and survival of juveniles (and potentially adults in the future). The proposed research has limited scientific value (it uses an advanced technique to improve conventional fish monitoring.**
Rating	**very good**

Justification

Is the study justified relative to existing knowledge? Is a conceptual model clearly stated in the proposal and does it explain the underlying basis for the proposed work? Is the selection of research, pilot or demonstration project, or a full−scale implementation project justified?

Comments	**The research could be useful for identifying, prioritizing, and correcting possible impediments to migration in a 30−mile reach of the Calaveras River. The population under study is interesting – a combination of resident rainbow trout and anadromous steelhead, with the possibility of interbreeding, residualizing, and otherwise**

	altering life history strategies in response to environmental (passage) conditions. The investigators have developed a reasonable conceptual model of the factors that may influence success of steelhead/rainbow trout. However, it is not clear whether the contribution of the Calaveras River stock of steelheads is a substantial enough proportion of the Central Valley stock to justify the considerable expense to carry out this study.
Rating	**very good**

Approach

Is the approach well designed and appropriate for meeting the objectives of the project? Is the approach feasible? Are results likely to add to the base of knowledge? Is the project likely to generate novel information, methodology, or approaches? Will the information ultimately be useful to decision makers?

Comments	**The general approach is sound – they will release PIT-tagged fish and search for them at fixed and mobile tag detecting stations downstream. Locations of the fixed detectors were made in consultation with local experts and seem appropriate. The physical data they plan to collect (Tasks 4.1 and 4.2) are very general – total streamflow measurements and water temperatures from a handful of gages, turbidity measurements at times not necessarily linked to events that would trigger or stop movements. Such physical data don't seem fine-grained enough to "determine the influence of environmental variables on O. mykiss migration characteristics and life-history preferences."**
Rating	**very good**

Feasibility

Is the approach fully documented and technically feasible? What is the likelihood of success?

Is the scale of the project consistent with the objectives and within the grasp of authors?

Comments	**The authors have already done some feasibility studies to determine if fish can be PIT tagged without negative effects and could subsequently be found with the detectors. While it appears that they will be able to detect tagged fish with either fixed or mobile/roving detectors, they didn't present their results related to fish behavior and survival. If behavior/survival of tagged juveniles is different from untagged, they may not collect reliable information on dynamics of the natural steelhead/rainbow trout stock in this river.** **Will they be able to differentiate between fish that died in the reach and fish that were entrained into unscreened diversions? Either way, they won't be detected at downstream stations, but the water management implications might be different. Similarly, while the conceptual model presented in Figure 4 is good, I doubt whether they will be able to quantify many of the boxes with the proposed monitoring plan. For example, if they assume that a juvenile that is not longer detected died in the Old Calaveras River channel, how will they determine what killed it? Reduced food? Increased predation? Stranding? Increased disease? To some extent, the particular cause of death suggests different water management strategies.**
Rating	**good**

Monitoring

If applicable, is monitoring appropriately designed (pre−post comparisons; treatment−control comparisons)? Are there plans to interpret monitoring data or otherwise develop information?

Comments	**Yes, see comments in other sections**
Rating	**very good**

Products

Are products of value likely from the project? Are contributions to larger data management systems relevant and considered? Are interpretive (or interpretable) outcomes likely from the project?

Comments	**The authors propose frequent reporting of results, ranging from monthly to annual to final reports at the conclusion of the 3-year study. If the rate of detection of PIT-tagged fish is good, the investigators will be able to answer some of the questions they pose in their hypotheses, i.e., those related to rates of movement and survival and the seriousness of passage barriers. However, they may not be able to satisfy the goal of identifying appropriate water management strategies for improving passage, because there may be multiple physical and biological explanations for the movements and survival they will measure, with no way to sort them out.**
Rating	**very good**

Additional Comments

Comments

Capabilities

What is the track record of authors in terms of past performance? Is the project team qualified to efficiently and effectively implement the proposed project? Do they have available the infrastructure and other aspects of support necessary to accomplish the project?

Comments	**The principal investigators appear to be well qualified to carry out the research, analyses, and information transfer tasks.**
Rating	**very good**

Budget

Is the budget reasonable and adequate for the work proposed?

Comments	**Yes.**
Rating	**good**

Overall

Provide a brief explanation of your summary rating.

Comments	**The investigators propose to use an innovative tool (new generation of PIT tags and detectors) to monitor the movements and survival of steelhead/rainbow trout. They will almost certainly develop better information than with older techniques (e.g., screw trap and netting). The data will be useful for understanding the dynamics of this steelhead stock, an essential element to restoring it to the Central Valley. However, the information will apply to a relatively short section of a single river in the basin. Unless a clear explanation for the observed movements and survivals can be gleaned from the general flow, habitat, and temperature data that will be compiled, the results may not be easily translated into water management strategies.**
Rating	**very good**

Technical Review #3

proposal title: Evaluation of Juvenile Oncorhynchus mykiss Migration and Life History Expression in the Calaveras River using Streamwidth Passive Integrated Transponder Technology

Review Form

Goals

Are the goals, objectives and hypotheses clearly stated and internally consistent? Is the idea timely and important?

Comments	**The statement of goals (determining travel rates, areas of mortality, and possible patterns of residualization) is reasonably clear. What is lacking (see below, under justification) is a sufficient linkage to the overall picture of salmon and steelhead conservation.**
Rating	**very good**

Justification

Is the study justified relative to existing knowledge? Is a conceptual model clearly stated in the proposal and does it explain the underlying basis for the proposed work? Is the selection of research, pilot or demonstration project, or a full−scale implementation project justified?

Comments	**Perhaps it is common knowledge and so needs no statement, but I found this proposal structured a bit oddly. The justification, which I would have thought should be up front, was back behind the details of the methods. Other than statements that imply how this river has been horribly mistreated over the years, there was little sense of the magnitude of the populations. Does this river produce a large fraction of the steelhead in the region? Did it ever, and might it again? That is, what is the scope for gain here. I can appreciate that every river is valuable, but some**

	sense of how this fits into the big picture is called for. The introduction was very specific to this river and could have benefitted from a broader persepctive. When I encountered the justification the study made more sense. Still, I could conceive of the need to have such detailed studies on a large number of rivers, and I wonder if this would be efficient. If the river is regularly de-watered for months on end, and has numerous barriers to fish passage, do we need a detailed PIT tagging study to tell us the nature of the problem? I am not down on research, but I feel that this study needed more justification.
Rating	**good**

Approach

Is the approach well designed and appropriate for meeting the objectives of the project? Is the approach feasible? Are results likely to add to the base of knowledge? Is the project likely to generate novel information, methodology, or approaches? Will the information ultimately be useful to decision makers?

Comments	**The general approach (tag fish, look at migration rates and routes, determine rates and areas of mortality or retention, and link to habitat) makes good sense. My concern is not so much with feasibility in the technical sense (see below) but whether the investigators will be able to tie all this together. There is a lot of detail on the PIT tags, and that is fine, but the tagging and even detection are not likely to be the weak links. My concern is that there seems to have been too little consideration of how the data will be managed and analyzed. The full assessment of these data will require extensive measurements of the physical and biological attributes of the different reaches between each detector, and this will require some really challenging statistical models. Otherwise, there will be heaps of detections but little knowledge gained that could be exported elsewhere (other than the really obvious things that would not have needed study in the first place).**

Rating	**fair**

Feasibility

Is the approach fully documented and technically feasible? What is the likelihood of success? Is the scale of the project consistent with the objectives and within the grasp of authors?

Comments	**The PIT tagging tachnology is a feasible one for this project, and I am confident that the investigators could handle this task. They seem experienced and this should not pose a problem. Perhaps I missed it, but I did not get much sense of the size of the river (width, depth, configuration, etc.) in the combined and separated channels. Such information would have helped assess how well the detector units will function, and there was a lot less detail on the detectors than on the tagging.**
Rating	**very good**

Monitoring

If applicable, is monitoring appropriately designed (pre−post comparisons; treatment−control comparisons)? Are there plans to interpret monitoring data or otherwise develop information?

Comments	**Monitoring of fish passage is adequately described, and such data should flow smoothly from the detector units assuming that they operate as planned. The habitat monitoring data are not well−described and it is not clear what standard measurement procedures will be used.**
Rating	**good**

Products

Are products of value likely from the project? Are contributions to larger data management systems relevant and considered? Are interpretive (or interpretable) outcomes likely from the project?

Comments	**The stream of data from fish tagging and detections will provide a very useful perspective on which channel the fish use, how fast they move, and where they delay or die (if this can be distinguished from retention). The linkage to habitat is the hard part, and (to repeat comments made elsehwere) this kind of product is not well described.**
Rating	**good**

Additional Comments

Comments

Capabilities

What is the track record of authors in terms of past performance? Is the project team qualified to efficiently and effectively implement the proposed project? Do they have available the infrastructure and other aspects of support necessary to accomplish the project?

Comments	**Though the people and organizations seem to have the technical expertise for the field work, I am concerned about the overall capabilities of this team. THe lead investigator has not submitted a proposal before to CalFed or any other public agency, and this suggests lack of experience with big projects. Moreover, none of the investigators whose c.v.s were provided has apparently published even a single paper in a scientific journal. This is really worrisome, as it makes me wonder if they have the expertise in data analysis and rigorous writing needed to get the benefit from this study design. Of particular concern is the aspect of data management and analysis. There will be mountains of data, and there seems to be no**

	clear plan for how to handle it (acquire, manage, archive, examine, etc.).
Rating	fair

Budget

Is the budget reasonable and adequate for the work proposed?

Comments	Given the nature of the field work, this budget is reasonable. There seems to be too much attention paid to fish tagging and detection and too little to obtaining and examining environmental data, however.
Rating	very good

Overall

Provide a brief explanation of your summary rating.

Comments	There are some good elements in this proposal, including use of remote PIT tagging systems for multiple detections, and the idea of linking habitat to fish migration and mortality. There is nothing proposal that cannot be done, though details on the river and habitat measurements were lacking. My concerns are largely in how this will relate to other systems (can the results be generalized or would this kind of work need to be done everywhere), how the data will be examined statistically, and whether the team has the capability to fully exploit the kind of data that will be obtained.
Rating	good